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AUTHORITY

711 HPW/OMA memo dtd 24 Feb 2016

DEPARTMENT OF THE AIR FORCE
AIR FORCE RESEARCH LABORATORY (AFMC)

22 December 2015

MEMORANDUM FOR ASC/GRI
ATTN: DON BUSE
2145 MONAHAN WAY
WRIGHT-PATTERSON AFB OH 45433-7017

FROM: AFRL/RHDO
4141Petroleum Rd
JBSA Fort Sam Houston TX 78235-5214

SUBJECT: Consultative Letter, AFRL-HE-BR-CL-2003-0007, Laser Safety Summary of the Large Aircraft Infrared Countermeasure (LAIRCM) Viper Laser, Phase 1

1. Introduction

1.1. Purpose: To assess the ocular and skin hazards associated with exposure to the LAIRCM Viper laser and recommend laser safety precautions for system use.

1.2. Background: The Air Force Research Laboratory, Optical Radiation Branch (AFRL/RHDO), JBSA Fort Sam Houston TX routinely evaluates lasers to assess possible hazards associated with the systems. AFRL/RHDO responded to requests by ASC/GRI and ASC/LUN to provide a laser hazard assessment of the LAIRCM Viper laser.

1.3. Scope: ASC/GRI recently arranged for AFRL/RHDO to evaluate a LAIRCM Viper laser. A joint Air Force and Navy team evaluated this laser during 18-20 February at the Northrop Grumman facility located in Rolling Meadows, IL. The activities performed include measurements of average output power/pulse energy, beam divergence, laser beam diameter near the output aperture, wavelengths, and pulse characteristics. The results of these measurements are classified and will be published as a consultative letter (CL) at a later date. This CL provides an unclassified laser safety summary to include Maximum Permissible Exposures (MPEs), Nominal Ocular Hazard Distances (NOHDs) for unaided and aided (binocular) viewing, as well as required eye protection Optical Densities (ODs), which are calculated in accordance with ANSI Z136.1-2000 *American National Standard for Safe Use of Lasers*. Results of this CL will also be forwarded to AFMOA/SGZR for Laser System Safety Review Board consideration.

2. Evaluation Personnel

Lt. Tracie Connor, Bioenvironmental Engineer, AFRL/RHDO, DSN 240-2420
Victor Villavicencio, Senior Optical Engineer, AFRL/RHDO (Northrop Grumman), DSN 240-6680
Wallace Mitchell, Senior Optical Engineer, AFRL/RHDO (Northrop Grumman), DSN 240-3718
Robert Aldrich, Laser Safety Specialist, Naval Surface Warfare Center, (540) 653-1149

3. Personnel Contacted

Doug Buse, LAIRCM System Engineer, ASC/GRI, DSN 674-8035 x3829
LtCol Jim Kelley, ASC/LUN, DSN 785-4715
Jim Smith, IRCM Logistics Product Manager, Northrop Grumman, (847) 259-9600 x5694
Paul Sorensen, LAIRCM System Safety Engineer, Northrop Grumman, (847) 259-9600 x4151

4. System Description

4.1. The purpose of the LAIRCM program is to protect Air Mobility Command's (AMC) large transport and tanker aircraft from Infrared (IR) Surface-to-Air Missiles (SAMs) by directing a high-intensity modulated laser beam into the missile seeker. The Viper laser head is a diode-pumped, solid-state source and optical parametric oscillator that generates multiple-wavelength mid-infrared optical energy simultaneously. The top photo in Figure 1 shows the Viper laser while the bottom photo shows the small laser transmitter assembly (SLTA), which consists of the Viper and the modified small transmitter unit. To meet AMC's immediate needs, Phase I of the program equips C-17 and C-130 aircraft with currently available technology, Northrop Grumman's AN/AAQ-24 (V) 12 Infrared Countermeasures Set, an upgraded version of the Directional Infrared Countermeasures (DIRCM) system. The LAIRCM program uses SLTAs in place of the DIRCM program's large lamp transmitter assemblies. Note that the LAIRCM system will consist of up to three (3) SLTAs per aircraft. The system will put a maximum of two SLTA's on a threat. The missile warning subsystem, AN/AAR-54, is common to both LAIRCM and DIRCM. Phase II of the LAIRCM program will incorporate advanced technology to increase the affordability and effectiveness of the system for the AMC fleet requirement. Phase II is expected to concentrate on miniature laser transmitter assemblies, advanced missile warning, and closed loop laser jammers.

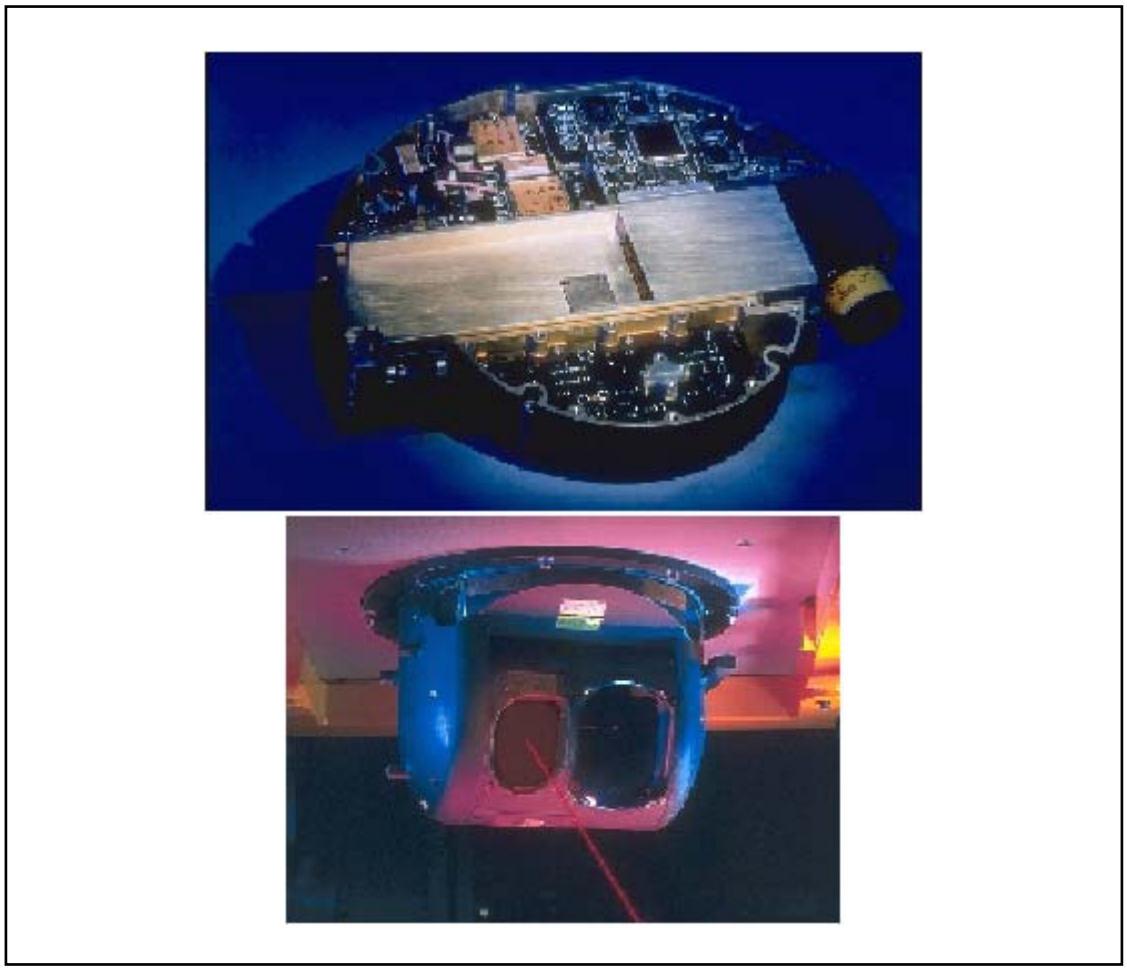


Figure 1. VIPER Photo

5. Hazard Analysis

5.1. Hazard Analysis Inputs: Though the laser parameters are classified and cannot be shown here, a worst-case parameter set with regard to hazard assessment was used in the analysis. Divergence and beam diameter values were chosen from analysis methods that most accurately modeled peak exposures and irradiance. Each wavelength

of the laser is assigned a letter from A-C, E-F, and R-Z. Wavelength F is inherently non-hazardous at its emitted energy. The energy emitted at wavelengths R-Z is negligible and not considered hazardous.

5.2. Maximum Permissible Exposures (MPEs)

5.2.1. The Maximum Permissible Exposure (MPE) limits as prescribed by ANSI Z136.1-2000 *American National Standard for Safe Use of Lasers* are listed in Table 1. The MPE is defined as the radiant exposure that personnel may receive without adverse biological effects. For both an ocular intrabeam and direct skin exposure, a ten-second exposure time applies for the Viper laser operating at wavelength bands A-C and E. For the purposes of classification, an exposure time of 100 seconds is used.

Table 1. Maximum Permissible Exposure (MPE) Values for the LAIRCM Viper Laser

Wavelength	Type of MPE	Exposure Duration (sec)	MPE
A and C	Intra-Beam Viewing	10	0.1 W/cm^2
	Skin Exposure	10	0.1 W/cm^2
B and E	Intra-Beam Viewing	10	8.0 x 10^{-6} J/cm^2
	Skin Exposure	10	8.0 x 10^{-6} J/cm^2

5.2.2. Note that while the Viper is a multiple-pulse laser, the MPE for wavelengths A and C is listed as an irradiance value instead of a radiant exposure value. This is because the pulse repetition frequency (PRF) of the Viper laser operates above the critical frequency calculated for wavelengths A and C. The critical frequency is defined in ANSI Z136.1 as the PRF that corresponds to the reciprocal of t_{min} and above which the laser output is considered continuous wave (CW).

5.3. Nominal Ocular Hazard Distances (NOHDs): Table 2 lists the NOHDs for various exposure conditions including unaided and aided viewing (as specified in DoD MIL-HDBK-828A). The NOHD is defined as the distance from an operating laser at which the radiant exposure is equal to the MPE. Ranges beyond the NOHD are safe for accidental viewing. The NOHD values incorporate an atmospheric attenuation coefficient that implies a conservative "very clear day" value (approximately 60-km visibility). The Nominal Skin Hazard Distance (NSHD) has the equivalent definition for skin exposures. Note that since the Viper is a laser that emits multiple wavelengths simultaneously, only one total NOHD is provided for each exposure condition. NOHD values are also provided for the remote possibility that a person could be exposed to the output beams from two SLTAs simultaneously.

Table 2. Hazard Distance Summary for the LAIRCM Viper Laser

Wavelength	Hazard Type	Exposure Duration (sec)	Unaided Viewing (meters) [ft]	7 x 50 mm Binocular (meters) [ft]	8 cm Binocular (meters) [ft]	12 cm Telescope (meters) [ft]
Multiple (**ONE** SLTA)	Intra-Beam Viewing NOHD	10	40 [132]	185 [607]	296 [971]	445 [1,460]
	Skin NSHD	10	40 [132]	N/A	N/A	N/A
Multiple (**TWO** SLTAs)	Intra-Beam Viewing NOHD	10	57 [187]	263 [863]	420 [1,378]	629 [2,064]
	Skin NSHD	10	57 [187]	N/A	N/A	N/A

5.4. Optical Density (OD) Requirements

5.4.1. The Optical Density (OD) is a measure of the opacity to radiation expressed in logarithmic units. Laser eye protection with equivalent or greater OD at the operating wavelengths of the laser will provide adequate protection.

5.4.2. Table 3 lists the minimum OD values at the various wavelengths required at the output aperture of the laser for unaided and aided (binocular) viewing. These values represent the maximum value obtained from near-

field beam profile analysis and also take into account the remote possibility that a person could be exposed to the output beams from two SLTAs simultaneously.

Table 3. Laser Safety Eye Protection OD Requirements for the LAIRCM Viper Laser
(Applies to both aided and unaided intra-beam viewing)

OD Required at the Laser Aperture					
Wavelength	**Exposure Time (sec)**	**OD**			
		Unaided Viewing	**7x50 mm Binocular**	**8 cm Binocular**	**12 cm Telescope**
A	10	1.5	2.0	2.0	2.0
B	10	1.0	0.0	0.0	0.0
C	10	1.4	0.0	0.0	0.0
E	10	1.1	1.6	1.6	1.6

5.4.3. Notes on Aided Viewing Hazards: The use of binoculars, telescopes, or other magnifying optics can significantly increase the hazards associated with viewing a laser. Table 2 lists the NOHD values associated with common military binocular specifications. These are the 7x50-mm binocular, the 8-cm aperture binocular, and the 12-cm aperture telescope. Table 3 summarizes the OD requirements associated with these optics. Also note that visible optics transmission values, as listed in ANSI Z136.1-2000, were used in calculating NOHD and OD values.

5.5. Laser Classification: The LAIRCM Viper laser has output parameters which classify it as a Class 4 laser according to the ANSI Z136.1-2000 *American National Standard for Safe Use of Lasers* and the IEC 60825-1 Edition 1.2 2001-08.

6. Conclusion/Recommendations

6.1. There is an eye hazard (cornea only) associated with the LAIRCM Viper laser under normal operational conditions. Therefore this device requires that personnel within the specified NOHDs wear adequate eye protection as listed in Table 3. Please contact AFRL/HEDO for further LEP information. There is also a skin hazard associated with exposure to this laser. Personnel should avoid direct skin exposure to the laser within the specified NSHDs. There is no diffuse reflection hazard. AFRL/HEDO recommends that the hazards associated with this laser can be properly mitigated through training and a laser safety program implemented within the units using the LAIRCM system. This safety program should include the following recommendations:

6.2. Medical surveillance is required, IAW AFOSH 48-139, for Class 4 lasers. The rationale for medical surveillance requirements and specific information of value to examining or attending physicians are included in Appendix E of ANSI Z136.1-2000. Current Surgeon General policy requires flyers to have eye exams during their yearly preventative health assessment. These exams shall include an amsler grid, distant and near visual acuity.

6.3. Never view the beam directly on axis through magnifying optics such as binoculars or telescopes without appropriate safety filters as magnifying optics have the ability to refocus laser light thus increasing the NOHD.

6.4. The systems should be marked with appropriate laser warning labels IAW AFOSH 48-139 and ANSI Z136.1-2000 and meet the laser safety design requirements as listed in Attachment 1.

6.5. Ensure a Unit Laser Safety Officer has been designated and has adequately trained all laser operators in laser safety IAW AFOSH 48-139 and ANSI Z136.1-2000.

7. Please feel free to contact the Optical Radiation Safety Team at DSN 240-4784 or 800-473-3549 if you have any questions concerning this hazard evaluation. Refer to the official Air Force Research Laboratory (AFRL) CL number on the front page of this document in any correspondence to this office.

//s//
WILLIAM P. ROACH, Lt Col, USAF, BSC
Chief, Optical Radiation Branch

Attachment:
1. Laser Safety Design Requirement Checklist

Cc:
AFMOA/SGZR
AFIERA/SDRH

Attachment 1: Laser Safety Design Requirement Checklist

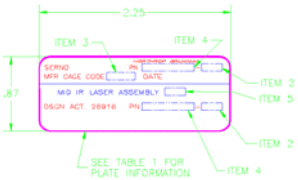
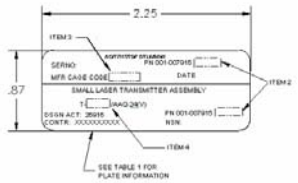
LASER SAFETY DESIGN REQUIREMENT CHECKLIST

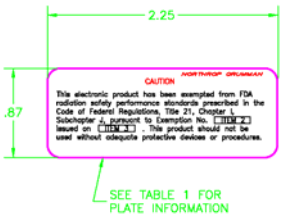
This checklist is intended to help the designer, procuring activity, or personnel responsible for laser safety stay within the laser safety design requirements for military lasers and associated support equipment. There may be requirements where the wording may not precisely apply to the particular situation; therefore, some individual interpretation of the requirements is necessary. Because each individual's interpretation of the requirements may differ, room has been made available to expand upon the answer to each requirement. This checklist should not be used by itself, but in conjunction with other references; e.g., MIL-STD-882,[1] ANSI Z136.1,[2] and AFOSH 48-139.[3]

EQUIPMENT DESCRIPTION

Equipment Name:	LAIRCM Viper Laser (Phase 1)
Model Number:	AN/AAQ-24 (V) 12
Serial Number:	SLTA s/n 002 with laser s/n 1004 and transmitter s/n S0195
Manufacturer:	Northrop Grumman
Address:	600 Hicks Rd. Rolling Meadows, IL 60008
Responsible Authority:	ASC/GRI
Address:	2145 MONAHAN WAY WRIGHT-PATTERSON AFB OH 45433-7017
Point of Contact:	Doug Buse
Address:	2145 MONAHAN WAY WRIGHT-PATTERSON AFB OH 45433-7017
Phone:	(937) 904-8035 x3829
Inspector:	Lt Tracie Connor and Robert Aldrich
Date:	18-20 Feb 2003

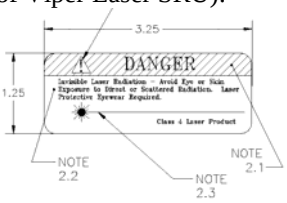
[1]MIL-STD-882C, *Military Standard System Safety Program Requirements*, 1993.
[2]ANSI Z136.1, *American National Standard for the Safe Use of Lasers*, American National Standard Institute Inc.
[3]AFOSH 48-139, *Laser Radiation Protection Program*, AFMOA/SGOR.

Item	Requirement	Yes/No	Comment
1	Is laser product provided with a tag or label permanently affixed to the device housing? (4.2.1)	YES	Viper Laser ID label is as follows (mounted to top of Viper Laser SRU):  "Viper Laser ID Label.bmp" *Larger version attached.* Small Laser Transmitter Assembly (SLTA) ID label 013-007504:  "SLTA ID Label.bmp' *Larger version attached.*
1a	Does such a tag or label contain the full name and address of the manufacturer, the laser model, and the place, month, and year of manufacture? (4.2.1)	NO	Label complies with MIL-STD-130 and includes manufacturer name and CAGE code. Date is coded as YYWW.
1b	Is label or tag information not expressed in code? (4.2.1)	NO	Date is indicated as YYWW, where YY represents the last two digits of the year of manufacture, and WW represents the week of manufacture.
2	In lieu of the certification label required by 21 CFR 1010.2; if laser is product exempted under 76EL-01 DOD, is a tag or label permanently affixed to the device housing so that it is readily accessible to view? (4.2.2)	No	Not visible when installed on aircraft.

Item	Requirement	Yes/No	Comment
2a	Does such label contain the following statement? (4.2.2) **CAUTION** **This electronic product has been exempted from FDA radiation safety performance standards prescribed in Title 21, Code of Federal Regulations, Chapter I, Subchapter J, pursuant to Exemption No. 76EL-01 DOD issued on 26 July 1976. This product should not be used without adequate protective devices or procedures.**	YES	Compliant exemption label is reflected on the Viper Laser mechanical drawing.   "Viper Exemption Label.bmp" *Larger version attached.*
3	Are laser products operational and adjustment controls located so that human exposure to laser radiation in excess of the appropriate MPE is unnecessary for the operation or adjustment of such controls? (4.2.3)	YES	Operational controls (Control Indicator Unit in cockpit) situated outside of laser path due to obscuration masks. There is no operator adjustment of this equipment. Laser is self-controlled.
4	Is laser product designed to preclude unintentional laser output (e.g., spontaneous firing)? (4.2.4)	YES	Laser firing is inhibited through detection of aircraft weight-ON-wheels condition. With weight-OFF-wheels, laser may react briefly to false threat signature. Duration is consistent with mission requirements. Aircrew is afforded protection through obscuration masks.
5	Are lasers and associated optics designed so that external secondary beams are not generated unless necessary for the performance of the intended function(s)? (4.2.5)	YES	Secondary beams are filtered to the extent practical, consistent with performance and mission requirements.
6	Are focused beams, hot spots, and collateral radiation minimized? (4.2.5)	YES	Beam has minimum divergence specification, verified at Viper Laser level.
7	Do lasers employing frequency shifting or harmonic multipliers reduce unnecessary emissions below MPE? (4.2.5)	YES	Unnecessary emissions are filtered at the SLTA level to the extent practical within mission requirements. Several wavelengths are mission critical.

Item	Requirement	Yes/No	Comment
8	Is the laser system designed to preclude unintentional self-oscillation, mode-locking, double-pulsing, or unwanted modes, when practicable? (4.2.6)	YES	This is a Q-switched multi-mode laser. There is no unintentional self-oscillation, mode-locking, or double pulsing. The design takes advantage of numerous modes and none of them are unwanted in that regard.
9	If unwanted modes cannot be eliminated, is laser classified as per the worst possible accessible emission level? (4.2.6)	YES	System has no unwanted modes by definition. Laser is classified by contractor using worst possible AEL, and considering all anticipated outputs.
10	Are interlocked protective housings provided to protect personnel from high-voltage sources and unnecessary laser and collateral radiation in excess of the AELs? (4.2.7)	NO	Personnel are protected from internal electrical hazards by equipment housing. Both SLTA and Viper Laser are designated as factory repair. No protective housing interlock is in place.
10a	Is aural or visual indication of interlock defeat provided? (4.2.7)	N/A	No interlock.
10b	Do interlocks return to their normal operation when access cover or door is returned? (4.2.7)	N/A	No interlock.
11	When laser radiation exceeding ANSI AEL for Class I is accessible, are visual indicators readily visible while wearing suitable laser protective eyewear? (4.2.7)	YES	
12	Do viewing ports and display screens, which allow the operator to view laser radiation, attenuate the radiation to limit personnel exposure to below the appropriate MPE? (4.2.8)	N/A	Operator does not have the need or the capability to view laser radiation.
13	Do laser product pointing or viewing optics having a magnifying power exceeding 1.0 include a built-in laser safety filter within the optical train that protects the operator from reflections from specular surfaces or exposures from force-on-force training? (4.2.9)	N/A	
13a	Is adequate visibility maintained when using laser safety filters? (4.2.9)	N/A	
13b	Are laser safety filters permanently attached or designed so that the optical train cannot be assembled without the filter? (4.2.9)	N/A	
13c	Is filter on viewing sight marked to indicate OD & wavelength (see 1425A table 2 and 3)? (4.2.9)	N/A	

Item	Requirement	Yes/No	Comment
14	Is system designed per MIL-STD-454, MIL-STD-882, and MIL-STD-2036? (4.2.10)	YES	Personnel hazard control is specified and implemented using MIL-HDBK-454 requirement 1 for guidance. System safety program is conducted per MIL-STD-882. In addition to these, design guidance is taken per applicable portions of ANSI Z136.1, 29 CFR 1910, and 21 CFR 1040.
15	**Items 15-23 are Class I, II, IIa, and IIIa laser requirements** Do laser warning labels for exempted lasers provide clear instructions to the operators, maintainers, and potential bystanders to preclude laser injury? (4.2.11)	N/A	
16	Do lasers classified as ANSI Class I, Class II, Class IIa, or Class IIIa meet the design (performance) requirements of 21 CFR Class I, Class II, Class IIa, or Class IIIa, respectively, except where such requirements restrict operational capability or security? (4.3.1)	N/A	
17	Do lasers classified as ANSI Class I, Class II, Class IIa, or Class IIIa meet the designation and warning requirements of 21 CFR Class I, Class II, Class IIa, or Class IIIa, respectively, with the exception that the ANSI classification will be displayed in the lower right corner rather than the FDA class? (4.3.2)	N/A	
18	Are labels permanently affixed or inscribed on such products as to be legible and readily accessible to view when the product is fully assembled for use? (4.3.2)	N/A	
19	Are warning labels affixed to the laser system housing near the beam exit port and/or fire button when possible in such a manner that viewing the label does not require personnel exposure to laser radiation? (4.3.2)	N/A	
20	Are Class II and Class IIIa lasers, as defined by ANSI, provided with a label similar to the examples illustrated in Figure 1? (4.3.2)	N/A	
20a	Is numerical output information [e.g., wavelength(s) and maximum power output (when unclassified)] located along the lower edge in a smaller font? (4.3.2)	N/A	
20b	Does the word **INVISIBLE** or **VISIBLE**, as appropriate, precede the word **RADIATION**? (4.3.2)	N/A	
20c	When camouflage may be compromised by labels, are muted colors appropriate to the camouflage paint scheme used? (4.3.2.1)	N/A	
20d	Is information classified in the interest of national security omitted from all labels? (4.3.2.2)	N/A	
21	When a Class I laser has a defeatable interlock that, when defeated, allows access to Class IIIb or Class IV emission levels, is an additional label that states the following installed on or near the access panel? (4.3.2.3) **DANGER** **Laser Radiation When Open and Interlock Defeated, Avoid Eye or Skin Exposure to Direct or Scattered Radiation**.	N/A	

Item	Requirement	Yes/No	Comment
22	If the laser is Class IIa, does it have an affixed label stating **ANSI Class IIa Laser Product--Avoid Long-Term Viewing of Direct Laser Radiation**? (4.3.2.4)	N/A	
23	If nonexempt lasers incorporate military labeling, has alternate labeling been requested by the manufacturer and approved as a variance by the FDA in accordance with 21 CFR 1040 (g) (10)? (4.3.2.5)	N/A	
24	**Items 24-44 are Class IIIb and Class IV laser design requirements** Are Class IIIb and Class IV lasers, as defined by ANSI, provided with a label similar to the examples illustrated in Figure 2? (4.4.1)	NO	Contents in position 2 are not included because wavelengths and output power/energy are classified. Viper Laser safety label is as follows (mounted to top of Viper Laser SRU):   "Viper Laser Safety Label.bmp" *Larger version attached.* SLTA Laser label on G4 cover (side of SLTA) indicates "CAUTION – LASER RADIATION WHEN OPEN. AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION."
24a	Are such labels permanently affixed or inscribed on such products to be legible and readily accessible to view when the product is fully assembled for use? (4.4.1)	N/A	Safety label is mounted to the top surface of the Viper Laser, which is readily accessible to view when the product is fully assembled. Viper Laser safety label not visible when Transmitter is installed on aircraft.
24b	Is the label affixed to the laser system housing near the fire button and exit port when the port is remote from the operator in such a manner that viewing the label does not require personnel exposure to laser radiation? (4.4.1)	N/A	Equipment uses no fire button. SLTA CAUTION label is on side of transmitter such that personnel exposure to laser radiation is not required to view.

Item	Requirement	Yes/No	Comment
24c	Does the label use the word **DANGER** and include the type of laser and the word **VISIBLE** or **INVISIBLE** preceding the word **RADIATION**? (4.4.1)	NO	SLTA label is a CAUTION label; does not specify VISIBLE or INVISIBLE.
24d	Does the label contain an appropriate instructional safety statement or control message for the operator or bystander as applicable? (4.4.1) For Class IIIb and Class IV ground target designators: **DO NOT AIM AT PERSONNEL OR FLAT GLASS SURFACES** For Class IV lasers that present a diffuse reflection hazard: **DO NOT AIM AT PERSONNEL OR FLAT GLASS SURFACES OR TARGETS WITHIN ___ METERS** Bystander warning for wavelengths 400 to 1400 nm; Class IIIb and Class IV lasers: **DO NOT LOOK INTO PORTHOLE** Bystander warning for wavelengths 1400 nm to 1 mm and 200 to 400 nm; Class IIIb and Class IV lasers: **DO NOT EXPOSE EYE OR SKIN TO DIRECT OR SPECULARLY REFLECTED BEAMS**	NO	SLTA Laser label on G4 cover indicates "CAUTION – LASER RADIATION WHEN OPEN. AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION." This label should state "DANGER" instead of "CAUTION".
24e	Do **DANGER** labels have **DANGER** printed upon a white background with a bright red oval around the word **DANGER** and contain a red star burst and black lettering? (4.4.1)	NO	SLTA Laser Safety label (on G4 cover) is an ANSI Z535.4 CAUTION label.
24f	When camouflage maybe compromised by such warning labels, are appropriate muted colors (i.e., olive drab) used? (4.4.1)	N/A	
24g	If the information is unclassified, are the ANSI laser hazard classification, wavelength(s), and maximum radiant power or energy added along the lower edge of the label? (4.4.1)	N/A	Viper Laser label indicates "Class 4 laser product". Information on specific laser parameters is excluded due to classification. No "Class 4 Laser Product" wording on SLTA CAUTION label.
25	Are measures taken to prevent single operator or material error causing unintentional laser output that exceeds ANSI AEL for Class I? (4.4.2)	YES	Laser operation requires: 1) weight-OFF-wheels indicated, 2) user data module (UDM) installed in CIU, CIU switched to "OPR" setting, and detection and tracking of a characterized threat.

Item	Requirement	Yes/No	Comment
26	Are at least two operator actions (one of which shall serve as a laser arming control) required to cause the laser to function? (4.4.2)	YES	CIU mode switch must be in "Operate" position, and the aircraft must be weight-OFF-wheels in order to be ready to react to missile warning and tracking interface. Self-controlled laser, however, UV sensor must trigger to enable IR sensor. If IR sensor triggers, the laser is activated.
27	Is laser output impossible when arming control is in the safe position? (4.4.2)	YES	
28	Is the laser fire trigger or switch clearly identified and physically protected to prevent accidental activation (when possible, the switch shall be a guarded positive action type that requires continuous operator intent to operate the laser product and laser output shall cease immediately upon release)? (4.4.3)	NO	No fire switch – laser is self-controlled.
29	If the laser is pulsed, is the activation circuitry designed so that continual depression or short-circuiting of the fire control switch will not cause repeated emissions [unless necessary for the performance of intended function(s)]? (4.4.3)	NO	No fire control switch – laser is controlled by computer logic from sensor data.
30	If operational considerations preclude the use of a dead-man switch, a toggled switch may be used if adequate design safeguards are provided to prevent long-term inadvertent lasing (e.g., through a watchdog timer and/or system logic switching device). Are these employed? (4.4.3)	N/A	
31	Does the laser have a permanently installed/ attached exit port cover that prevents access by any part of the body to all laser radiation in excess of ANSI AEL for Class I? (4.4.4)	YES	Self-stows in OFF position.
31a	Does the cover chosen clearly indicate that it is in place (safe) or open? (4.4.4)	YES	
31b	Is the cover designed to withstand repeated laser firings when it is in either position? (4.4.4)	YES	
32	Is a readily available remote-control interlock capability incorporated on the laser or auxiliary power supply systems? (4.4.5)	N/A	Contractor use only.
32a	Does the remote control connector have an electrical potential no greater than 130 rms. V between terminals (not essential if the laser is always directed into an interlocked set enclosure for maintenance or service procedures)? (4.4.5)	N/A	
32b	When the terminals of the connector are not electrically joined, is human access to all laser radiation and collateral radiation in excess of ANSI AEL for Class I prevented? (4.4.5)	N/A	When Viper Laser prime power is disabled, all laser radiation is prevented.
32c	Is an intentional reset needed to reactivate the system once disconnected? (4.4.5)	N/A	

Item	Requirement	Yes/No	Comment
33	Is the boresight alignment and retention designed consistent with system mission requirements (considered a safety-critical item)? (4.4.6)	YES	Aircraft-installed equipment performs autoboresight function upon system initialization and periodically thereafter. Self bore-sighting every 15 minutes (internal process).
34	Are laser status (emission) indicators (aural or visual or as specified by the procuring agency) provided to inform the operator when the laser is prepared to fire (armed) and when the laser is actually firing? (4.4.7)	YES	
34a	If visual indicators are used for operation or maintenance, are they visible during daylight, nighttime, and when viewed through appropriate protective eye wear? (4.4.7)	YES	
34b	Are indicators located so that viewing does not require personnel exposure to laser radiation in excess of the ANSI AEL for Class I? (4.4.7)	YES	
35	Is there a means to differentiate between armed and firing and is it consistent with MIL-STD-1425 (continuous tone or light is armed and intermittent tone or blinking light is firing)? (4.4.7)	YES	Armed = “On” Firing = Tone
36	If the laser system is installed on an aircraft, is it designed to prevent laser output while the aircraft is not airborne? (4.4.8)	YES	Laser operation logic is tied to aircraft WOW switch such that radiation is disabled with weight-ON-wheels.
36a	Is an override switch for ground maintenance designed to prevent inadvertent activation? (4.4.8)	YES	Override switch by itself is not sufficient to allow laser activation. Proper smart card, CIU switch setting, and threat stimulus are prerequisites for lasing.
37	Does the laser product incorporate controls to optimize positive operator control of beam pointing? (4.4.9)	NO	Self-controlled
37a	Does it include a means of ensuring boresight retention and software systems safety? (4.4.9)	YES	Gimbal location is continuously checked.
38	For systems with automatic target tracking capability, is an automatic disable capacity incorporated to inhibit laser firing if target tracking outside the system specifications occurs or when the laser sight line reaches the gimbal limits or the system mask limit? (4.4.9)	YES	Aircraft obscuration data (soft and hard masking) is used by the system to avoid self-illumination of the aircraft.
39	If no hardware stops are installed, are at least two independent systems capable of disabling the laser (a provision to override these automatic features during combat is permitted)? (4.4.9)	N/A	Obscuration mask disables laser. Two independent software checks are in place for Azimuth/ Elevation pointing angles that must agree prior to firing. Failed autoboresight, turret aiming, or communication during BIT disables the Transmitter.

Item	Requirement	Yes/No	Comment
40	For lasers using a beam scanning technique, if irregularities not normal to the operation and unintended pattern changes increase the hazard potential of the laser product, does it include a feature that terminates or reduces the beam output to ANSI AEL for Class I immediately upon the cessation of scanning irregularities (change in either scan velocity or amplitude)? (4.4.10)	N/A	Equipment does not use beam scanning.
41	If a training mode is required for the laser, are provisions made (beam attenuator, expander, diffuser or less-hazardous lasers, TV cameras, etc.) to reduce hazardous emissions to the lowest level consistent with training requirements? (4.4.11)	N/A	There is no training mode.
42	If the laser can be used in both a mission and a training mode, is a visual indication provided to inform the operator and outside observers that the laser is positively in the training mode? (4.4.11)	N/A	There is no training mode.
43	Have the system's Nominal Ocular Hazard Distance (NOHD), skin hazard distance, diffuse reflection hazard determination, protective eye wear requirements, buffer zone requirements, and safety parameters been certified by measurements by the AFRL/HEDO at Brooks AFB, TX and approved by AFRL/HEDO? (4.4.13)	YES	
44	Do aiming optics employ a reticle that can be viewed under any illumination conditions? (4.4.14)	N/A	Equipment does not use such aiming.
44a	Does the reticule not impair dark adaptation of observer's eyes? (4.4.14)	N/A	
44b	Is the reticle calibrated so the operator can determine the proximity of the laser beam to target buffer zones? (4.4.14)	N/A	

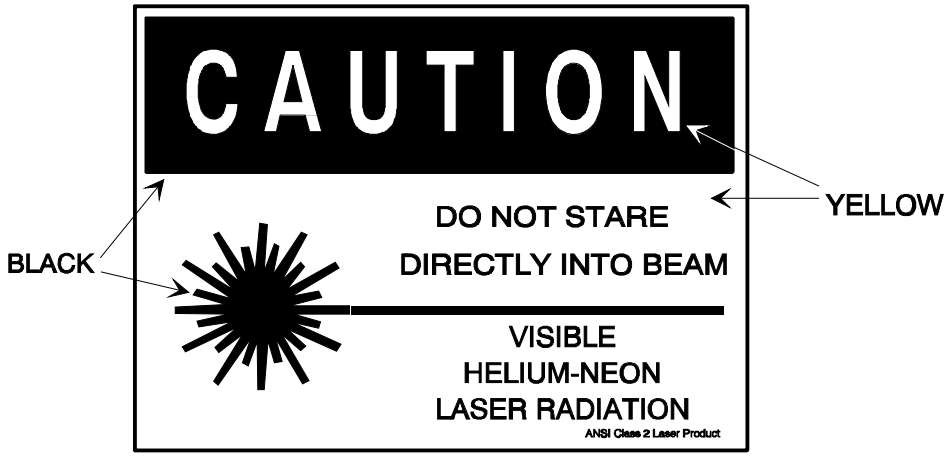


FIGURE A-1a. EXAMPLE OF A CAUTION LABEL FOR CLASS 2 LASERS

FIGURE A-1b. EXAMPLE OF A CAUTION LABEL FOR CLASS 3a VISIBLE AND NEAR-INFRARED LASERS

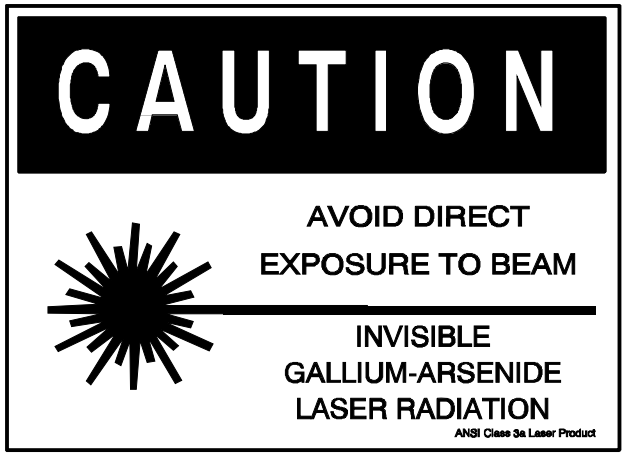


FIGURE A-1c. EXAMPLE OF A CAUTION LABEL FOR CLASS 3a INFRARED AND ULTRAVIOLET LASERS

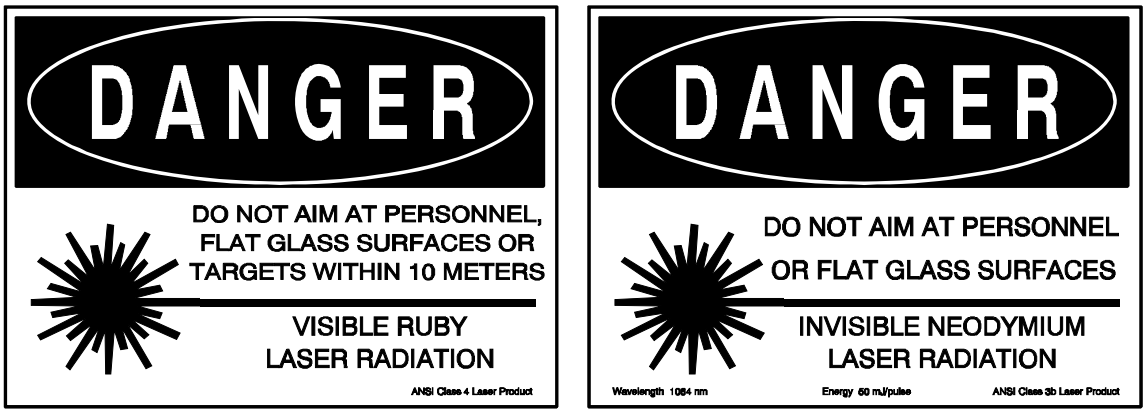


FIGURE A-2a. EXAMPLES OF DANGER LABELS FOR CLASS 3b AND CLASS 4 VISIBLE AND NEAR-INFRARED LASERS

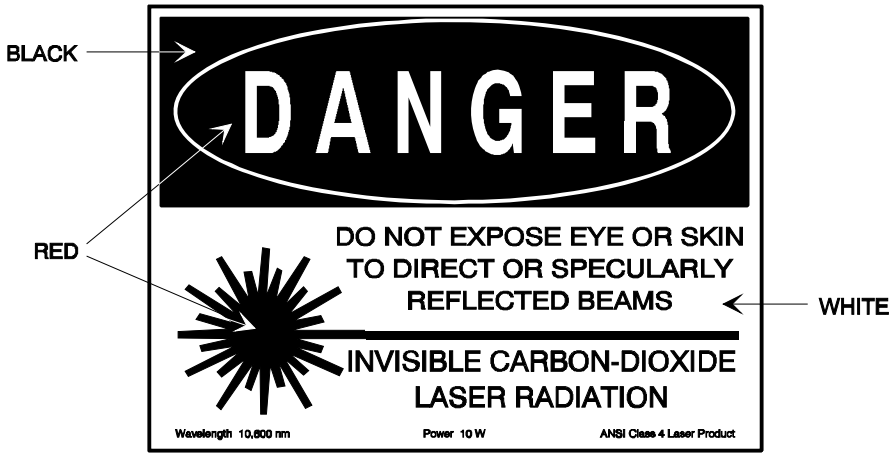
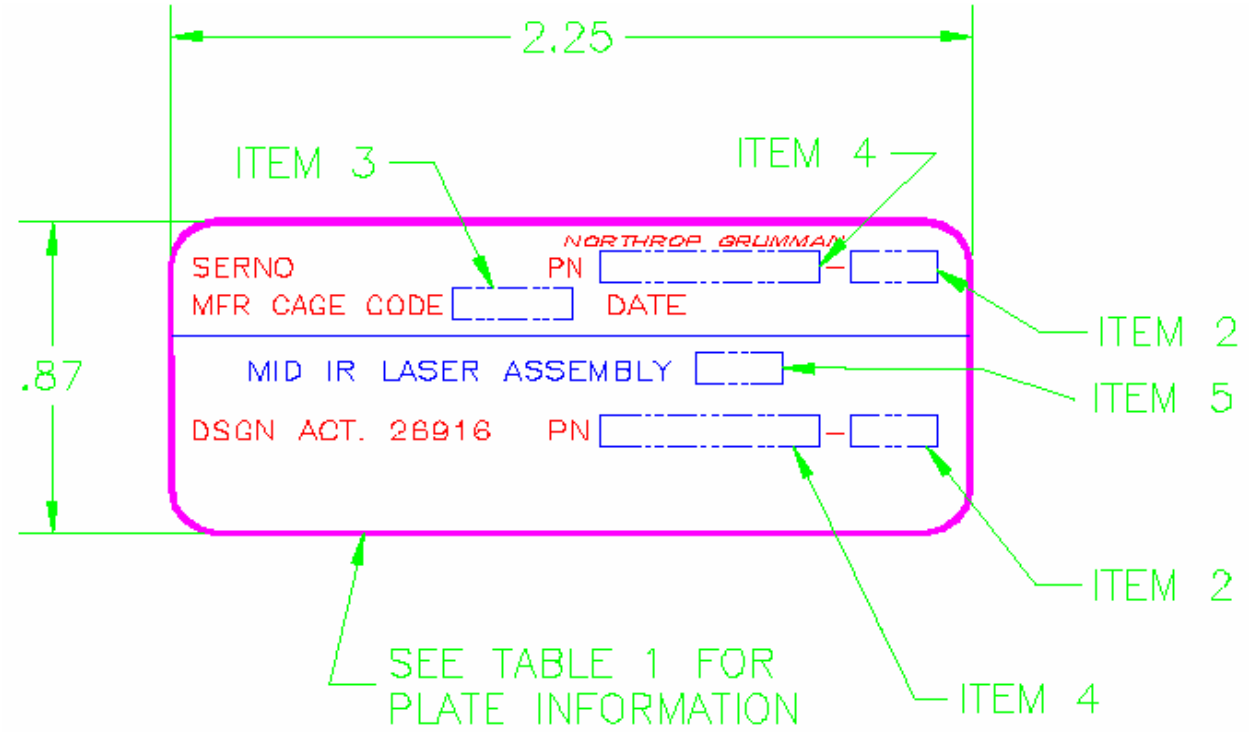
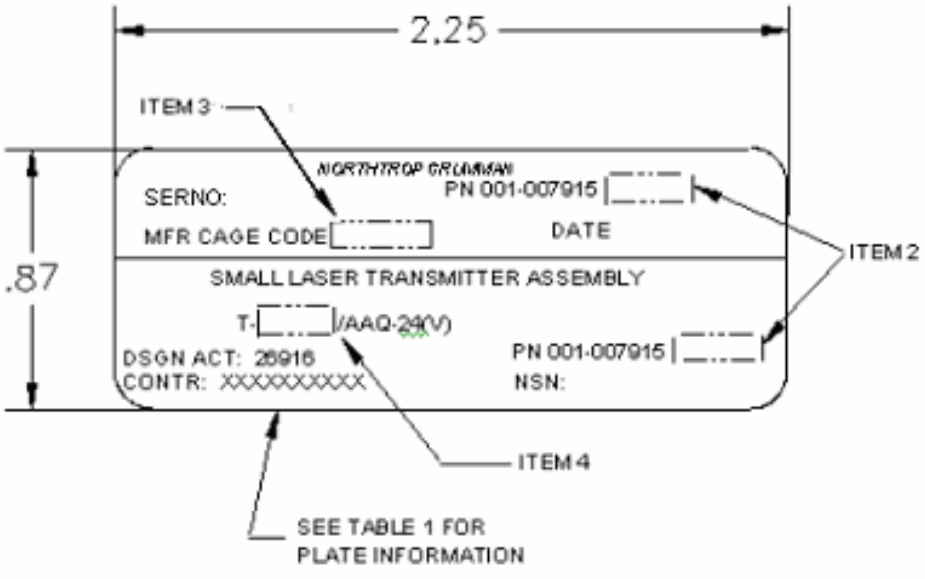


FIGURE A-2b. EXAMPLE OF A DANGER LABEL FOR CLASS 3b AND CLASS 4 INFRARED AND ULTRAVIOLET LASERS

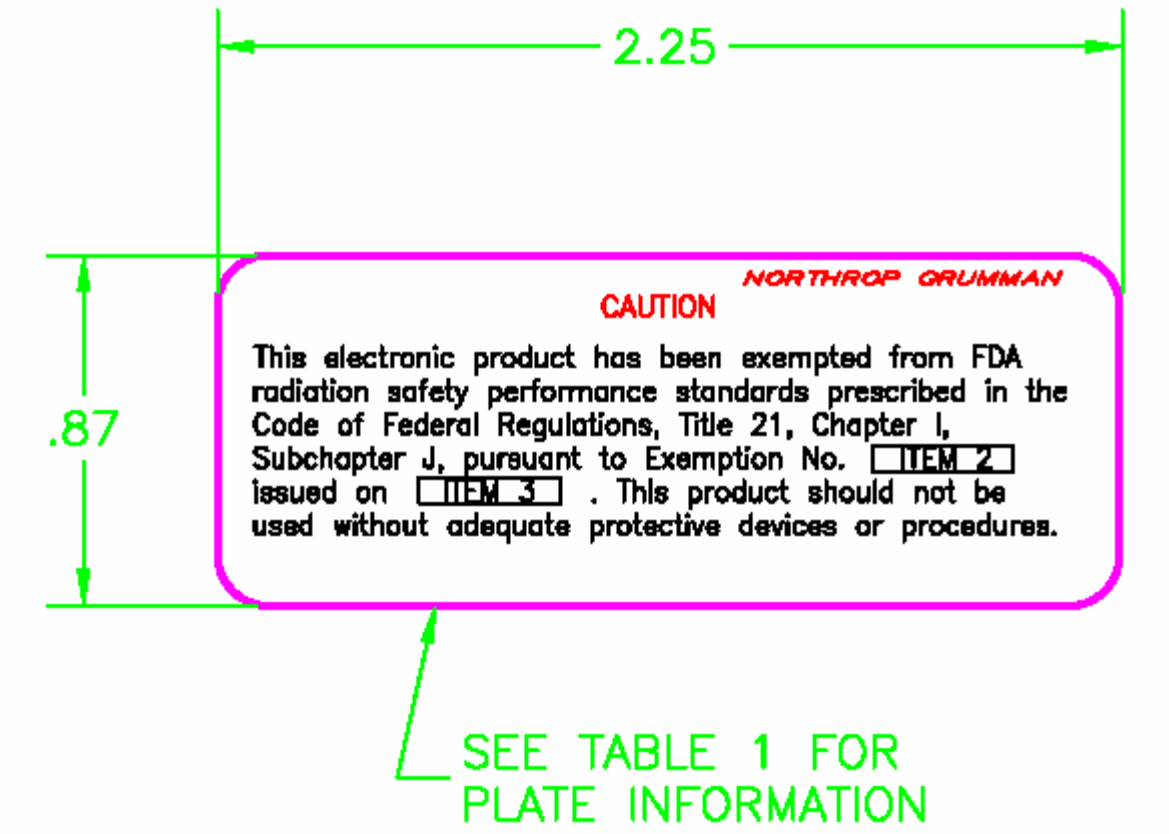
PDF Format Picture Extraction Page



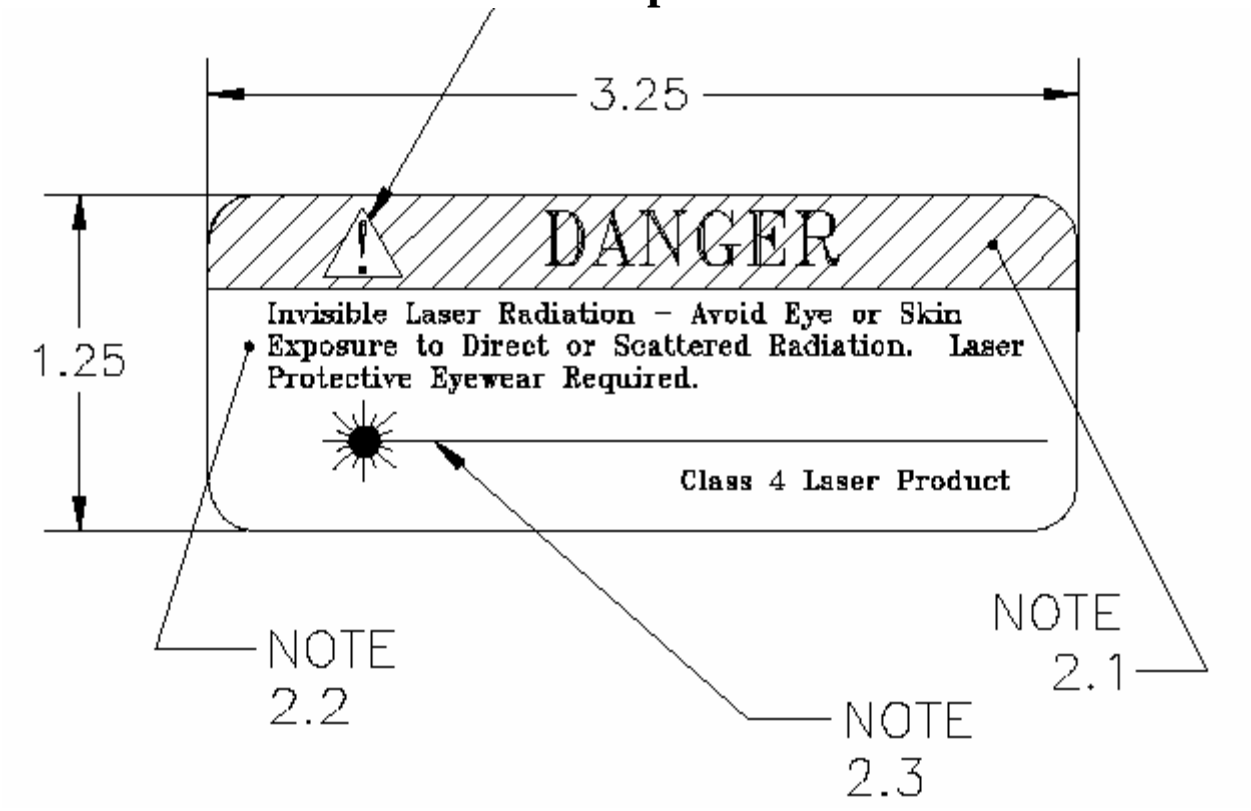
VIPER Laser ID Label



SLTA ID Label



VIPER Exemption Label



VIPER Laser Safety Label

DEPARTMENT OF THE AIR FORCE
AIR FORCE RESEARCH LABORATORY
WRIGHT-PATTERSON AIR FORCE BASE OHIO 45433-7008

24 February 2016

MEMORANDUM FOR DTIC-CQ
8725 JOHN J. KINGMAN ROAD
FORT BELVOIR, VA 22060-6218

FROM: 711 HPW/OMA (STINFO)
2947 Fifth Street
Wright-Patterson AFB, OH 45433-7913

SUBJECT: Request to Change the Distribution Statement on a Technical Report

This memo documents the requirement for DTIC to change the distribution statement on the following consultative letter from distribution statement C to A Approved for Public Release; distribution is unlimited.

AD Number: ADB348439
Publication number: AFRL-HE-BR-CL-2003-0007
Title: Laser Safety Summary of the Large Aircraft Infrared Countermeasures (LAIRCM) Viper Laser, Phase I

Reason for request: The current Distribution C limits release of the results of this report to US Government Agencies and their contractors. The Deputy Chief Engineer for the LAIRCOM SPO has requested that the report be approved for Distribution A to allow them to release it to other countries interested in purchasing their product. Changing the report to Distribution A will allow the customer to continue with the sale of this product.

Carlos Pineiro
CARLOS PINEIRO
STINFO Officer
711th Human Performance Wing